PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-267122
(43)Date of publication of application : 29.09.2000

(51)Int.Cl. G02F 1/1343
G02F 1/1365
G09F 9/30
G09F 9/35
H04N 5/66
H04N 9/30

(21)Application number : 11-068711
(22)Date of filing : 15.03.1999

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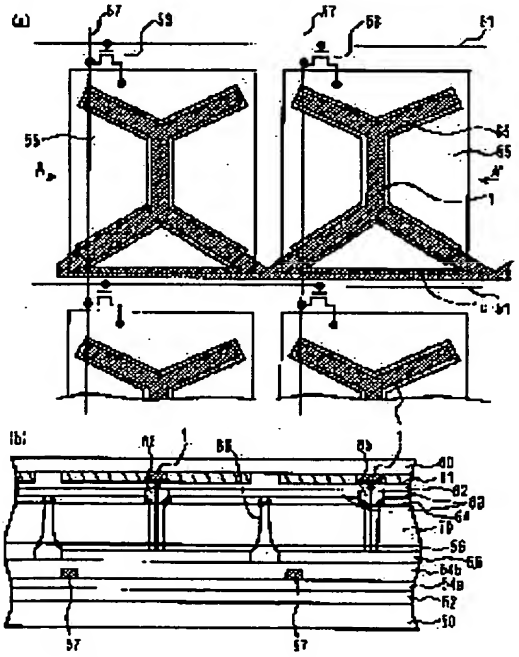
(54) VERTICAL ALIGNMENT TYPE LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a liquid crystal display device of high display quality by preventing alignment direction from being disturbed by external influence in a vertical alignment type liquid crystal display device in which an alignment control window is formed in a common electrode to control the alignment direction.
SOLUTION: On the opposing substrates 50, 60, pixel electrodes 55 and a common electrode 63 where alignment control windows 65 are made open are formed. In the areas overlapping the alignment control windows 65 and between the substrate 60 and color filters 61 alignment control auxiliary electrodes 1 are formed, and a voltage differing from pixel electrodes 55 in polarity is applied thereto. Thus, an electric field is formed in the areas of the alignment control windows 65 and the alignment direction of the liquid crystal molecules is controlled more strongly.



LEGAL STATUS

[Date of request for examination] 07.01.2005

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

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CLAIMS

[Claim(s)]
[Claim 1] The 1st substrate with which multi-line formation of the estranged pixel electrode was carried out, and the 2nd substrate with which the common electrode with which said 1st substrate is countered and said pixel electrode is countered was formed, In the liquid crystal display equipped with the liquid crystal which has the negative dielectric constant anisotropy enclosed between said 1st and 2nd substrates The perpendicular orientation mold liquid crystal display characterized by having the orientation control aperture which comes to carry out opening of said common electrode to the field corresponding to said pixel electrode of said common electrode, and preparing an orientation control auxiliary electrode in it between said common electrode and said 2nd substrate.
[Claim 2] Said orientation control auxiliary electrode is a perpendicular orientation mold liquid crystal display according to claim 1 characterized by superimposing on said orientation control aperture and being formed through an insulator layer.
[Claim 3] A part of insulator layer [at least] between said orientation control auxiliary electrodes and common electrodes is the perpendicular orientation mold liquid crystal display according to claim 2 characterized by being the color filter which makes a predetermined color light to penetrate.
[Claim 4] It is the perpendicular orientation mold liquid crystal display according to claim 1 characterized by for said orientation control auxiliary electrode being a transparent electrode, and forming this orientation control auxiliary electrode all over the field which counters said pixel electrode.
[Claim 5] For the electrical potential difference impressed to the pixel electrode with which it connects with the line writing direction, and this orientation control auxiliary electrode counters this orientation control auxiliary electrode, said orientation control auxiliary electrode is a perpendicular orientation mold liquid crystal display according to claim 1 to 3 characterized by impressing the electrical potential difference of reversed polarity by making into a center the electrical potential difference impressed to said common electrode.
[Claim 6] It is the perpendicular orientation mold liquid crystal display according to claim 5 which the electrical-potential-difference impression method of said liquid crystal display is impressed by the Rhine reversal method which reverses applied voltage for every line, and is characterized by carrying out electrical-potential-difference impression of said orientation control auxiliary electrode with said pixel electrode of the line which adjoins said pixel electrode with which this orientation control auxiliary electrode counters.
[Claim 7] It is the perpendicular orientation mold liquid crystal display according to claim 6 which is connected to said data line, has further the precharge electrode precharged to said pixel electrode, and is characterized by supplying an electrical potential difference to said orientation control auxiliary electrode with said precharge electrode.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the improvement of the display quality of the perpendicular orientation mold LCD which has an orientation control aperture in more detail about a liquid crystal display (Liquid Crystal Display;LCD).
[0002]
[Description of the Prior Art] In LCD of the perpendicular orientation mold using negative liquid crystal with a dielectric constant anisotropy and the negative perpendicular orientation film, the perpendicular orientation mold LCD which has the orientation control aperture which controls the direction of orientation of liquid crystal to JP,6-301036,A etc. is proposed. This type of LCD is explained below.
[0003] The top view of LCD where drawing 6 (a) has an orientation control aperture, and drawing 6 (b) are the A-A' sectional view. On the 1st substrate 50, the gate line 51 is formed, this is covered and gate dielectric film 52 is formed. The thin film transistor (Thin Film Transistor;TFT) 53 which consists of polish recon film is formed in besides. A part of gate line 51 serves as a gate electrode of TFT53. These are covered, an interlayer insulation film 54 is formed, the pixel electrode 55 which consists of ITO (indium tin oxide) is formed on an interlayer insulation film 54, and it connects with TFT53 through the contact hole by which opening was carried out to the interlayer insulation film 54. On the pixel electrode 55, the perpendicular orientation film 56 which consists of an organic system ingredient like polyimide or an inorganic system ingredient like a silane system ingredient is formed. The interlayer insulation film 54 is two-layer, and the data line 57 is formed on interlayer insulation film 54a. It connects with the source field of TFT53, and the data line 57 supplies a charge to the pixel electrode 55, when the gate line 51 turns on. Of the electrical potential difference impressed to the data line 57, in order that liquid crystal may prevent inclining directly, the data line 57 is superimposed and formed in the bottom of the pixel electrode 55.
[0004] A color filter 61 is formed in the location which counters the pixel electrode 55, and the common electrode 63 which consists of ITO etc. through an insulator layer 62 further covers two or more pixel electrodes 55 in the 2nd substrate 60 which countered the 1st substrate 50 and has been arranged, and is formed in it. On the common electrode 63, the same perpendicular orientation film 64 as the 1st substrate 50 side is formed. The orientation control aperture 65 is formed in the location corresponding to the pixel electrode 55 at the common electrode 63. The orientation control aperture 65 is the field of an electrode absence where opening of the common electrode was carried out, for example, has the configuration which connected the alphabetic character of "Y" with vertical reverse as illustrated.
[0005] Between these 1st substrates 50 and the 2nd substrate 60, liquid crystal 70 is enclosed and it is controlled according to the field strength formed of the electrical potential difference impressed between the pixel electrode 55 and the common electrode 63, the sense, i.e., the orientation, of a liquid crystal molecule. The polarizing plate which is not illustrated makes a polarization shaft intersect perpendicularly in the outside of the 1st substrate 50 and the 2nd substrate 60, and is arranged on it. In case the liquid crystal 70 controlled by different orientation for every display pixel is passed, it becomes irregular, and the linearly polarized light which passes through between these polarizing plates is controlled by desired permeability.
[0006] Liquid crystal 70 has the property which carries out orientation so that it may have the negative dielectric constant anisotropy, namely, may fall to the direction of electric field. The perpendicular orientation film 56 and 64 controls the initial orientation of liquid crystal 70 perpendicularly. In this case, the linearly polarized light which the liquid crystal molecule is perpendicular to the perpendicular orientation film 56 and 64 at the time of no electrical-potential-difference impressing, and escaped from one polarizing plate passes the liquid crystal layer 70, is intercepted with the polarizing plate of another side, and

a display is recognized as black. With this configuration, if an electrical potential difference is impressed between the pixel electrode 55 and the common electrode 63, electric fields 66 and 67 are formed and a liquid crystal molecule inclines. At the edge of the pixel electrode 55, electric field 66 become the configuration where it inclined aslant toward the common electrode 63 side from the pixel electrode 55. Similarly, since the edge of the orientation control aperture 65 also has the absent electrode, electric field 67 become the configuration where it inclined toward the pixel electrode 55. Since the direction of orientation of liquid crystal is controlled to become perpendicular to this leaning electric field, a liquid crystal molecule inclines toward the direction of the inside of the pixel electrode 55, and the orientation control aperture 65. Consequently, the linearly polarized light which escaped from one polarizing plate receives a birefringence in the liquid crystal layer 70, it changes to elliptically polarized light, the polarizing plate of another side is passed, and the display approaches white.

[0007] If the gate line 51 and the data line 57 both turn on the pixel electrode 55, an electrical potential difference will be impressed through TFT and it will drive the liquid crystal of the right above of it. LCD is displayed by impressing each electrical potential difference to each pixel electrode 55. That is, the field in which the pixel electrode 55 is formed serves as a pixel.

[0008] Moreover, directly under orientation control aperture 65, since the common electrode 63 is absent, electric field are not formed of electrical-potential-difference impression, either, but a liquid crystal molecule is fixed to an initial orientation condition, i.e., a perpendicular direction. By the continuation somatic of liquid crystal, the direction of orientation of liquid crystal counters on both sides of the orientation control aperture 65, and a large angle of visibility is obtained by this.

[0009] Next, the electrical-potential-difference impression method of LCD is described. Drawing 7 is a timing chart which shows the electrical potential difference impressed to the gate line 51 and the data line 57, and the electrical potential difference of the pixel electrode driven by it. The electrical potential difference impressed, respectively is shown in the 2nd gate line 51 by which drawing 7 (a) adjoins the 1st gate line 51, and (b) adjoins the 1st gate line, and, as for (c), the electrical potential difference of the pixel electrode 55 with which (d) is controlled by the 1st gate line and data line, and the pixel electrode 55 with which (e) is controlled by the 2nd gate line and data line is shown in it at the data line 57. An electrical potential difference is impressed to the gate line 51 of 1 horizontal-synchronization period (it is henceforth written as 1H) 1st, and this is turned on. TFT53 of the pixel electrode 55 of the train corresponding to this turns on because the 1st gate line 51 turns on. Between 1H, to each data line 57, the electrical potential difference according to the image to display is impressed, and, as for the pixel electrode 55 of this train, that electrical potential difference is held to it. By the following 1H, the 1st gate electrode 51 is turned off and the 2nd gate electrode 51 turns it on. By this, TFT of the pixel electrode 55 corresponding to the 2nd gate line turns on, and the pixel electrode 55 of this train holds the electrical potential difference of the data line 57 similarly. Like the following, an electrical potential difference is given to the pixel electrode 55 of each line at every 1H, the liquid crystal corresponding to this is driven, and an image is displayed. Here, in order to prevent degradation of liquid crystal, the direction of electric field is reversed for every adjoining line. namely, the pixel electrode 55 of a line which the 1st gate line controls -- the potential Vc (for example, 6V) of the common electrode 63 -- predetermined potential (for example, 4V) -- the electrical potential difference Vc which impressed the high electrical potential difference Vhigh (10V), and reversed it to the pixel electrode 55 of an adjoining line, i.e., the potential of the common electrode 63, -- predetermined potential -- the low electrical potential difference Vlow (2V) is impressed. In case an electrical potential difference is again impressed to the pixel electrode 55 of the line of the 1st gate line, Vlow reversed like the point is impressed. The impression method of such an electrical potential difference is called the Rhine reversal method. Since the applied voltage of a pixel electrode is reversed focusing on the potential Vc of the common electrode 63 according to the Rhine reversal, the configuration of electric field is the same and a direction becomes reverse for every line.

[0010]

[Problem(s) to be Solved by the Invention] The perpendicular orientation mold LCD of the type which has an above-mentioned orientation control aperture It compares with LCD of the type which gives rubbing and generally controls the direction of orientation of liquid crystal. The force which controls the direction of orientation is weak, for example, the thickness of the liquid crystal layer 70 changes with the biases of distribution of the spacer which has specified the thickness of the liquid crystal layer 70, or If that electric field are built from the external world etc. has the factor (it is called disturbance below) which disturbs the direction of orientation, the viewing-angle property that the directions of orientation of liquid crystal are turbulence and a pixel will change. Liquid crystal has continuation somatic and the turbulence of some

directions of orientation affects it also in the direction of orientation of the liquid crystal in a pixel. A boundary with the liquid crystal of the direction of right (it is unfixed by time) orientation produces in somewhere the liquid crystal with which the direction of orientation was in disorder, and it becomes the surface of discontinuity of the direction of orientation, and the so-called disclination here. Since light does not penetrate the field which disclination generated, a numerical aperture falls. Moreover, since the turbulence of the direction of orientation by disturbance differs and is produced for every pixel, a screen is rough, and appears and the display quality of LCD deteriorates.

[0011] Moreover, if a glass substrate is charged in plus according to an external factor, the field which counters will be charged in a reverse charge, i.e., minus. Since an electrical potential difference is impressed to a common electrode, there is little effect of electrification, but an electrode is not formed in an orientation control aperture, but since electrical-potential-difference impression is not carried out, it means having been charged with as. If the inside of an orientation control aperture is charged, the electric field which are not planned by this will occur and effect will be done in the direction of orientation of the liquid crystal molecule in a pixel. Macroscopically, the effect of electrification may change a color like silverfish partially. Moreover, electrification can also serve as the above-mentioned disturbance.

[0012] This invention aims at offering LCD with more high display quality in the perpendicular orientation mold LCD of the type which has an orientation control aperture.

[0013]

[Means for Solving the Problem] The 1st substrate with which multi-line formation of the pixel electrode which this invention was made in order to attain the above-mentioned purpose, and was estranged was carried out, In the liquid crystal display equipped with the liquid crystal which has the negative dielectric constant anisotropy enclosed between the 2nd substrate with which the common electrode which counters the 1st substrate and counters a pixel electrode was formed, and the 1st and 2nd substrates It is the perpendicular orientation mold liquid crystal display which has the orientation control aperture which comes to carry out opening of the common electrode to the field corresponding to the pixel electrode of a common electrode, and prepared the orientation control auxiliary electrode in it between a common electrode and the 2nd substrate.

[0014] Moreover, an orientation control auxiliary electrode is superimposed on an orientation control aperture, and is formed.

[0015] Moreover, an orientation control auxiliary electrode is a transparent electrode, and is formed all over the field which counters a pixel electrode.

[0016] Moreover, a liquid crystal display impresses an electrical potential difference to a pixel electrode, and drives liquid crystal, the orientation control auxiliary electrode is connected with the line writing direction, and the reversed electrical potential difference is impressed to this orientation control auxiliary electrode with the pixel electrode which this orientation control auxiliary electrode counters.

[0017] Moreover, the electrical-potential-difference impression method of a liquid crystal display is impressed by the Rhine reversal method which reverses applied voltage for every line, and electrical-potential-difference impression of the orientation control auxiliary electrode is carried out with the pixel electrode of the line which adjoins the line of the pixel electrode with which this orientation control auxiliary electrode counters.

[0018]

[Embodiment of the Invention] Drawing 1 (a) is the top view of the 1st operation gestalt of this invention, and (b) is the sectional view. The number same about the same configuration as the conventional LCD is attached, and explanation is omitted. On the 1st substrate 50, the gate line 51 which extends in a line writing direction is formed, and TFT53 which used the part as the gate electrode is formed. The data line 57 which extends in the direction of a train is connected to the pixel electrode 55 through TFT53, and the perpendicular orientation film 56 with which rubbing processing is not performed is formed on the pixel electrode 55. The data line 57 is formed on interlayer insulation film 54a. A color filter 61 is formed on the 2nd substrate 60 which countered the 1st substrate 50 and has been arranged, the common electrode 63 and the perpendicular orientation film 64 with which rubbing processing is not performed prepare through an insulator layer 62 on this, and it is ********. The orientation control aperture 65 which controls the direction of orientation of liquid crystal is formed in the common electrode 63. Between these 1st substrates 50 and the 2nd substrate 60, it is loaded with the liquid crystal 70 which has a negative dielectric constant anisotropy, and orientation is controlled according to the field strength formed of the electrical potential difference impressed between the pixel electrode 55 and the common electrode 63.

[0019] The big difference with the former is the point that the orientation control auxiliary electrode 1 is

formed between the 2nd substrate 60 and a color filter 61. The orientation control auxiliary electrode 1 has the configuration where connection section 1c connected with a line writing direction was connected in the configuration which connected the "Y" alphabetic character with vertical reverse, for example, becomes it from metals, such as chromium, and transparent electrodes, such as ITO, so that it may superimpose on the field in which the orientation control aperture 65 was formed. However, it is more desirable for a transparent electrode to be a metal since resistance is generally high as compared with a metal.

[0020] Now, an electrical potential difference higher than the common electrode 63 is impressed to the pixel electrode 55, and the line of electric force which faces to the common electrode 63 from the pixel electrode 55 presupposes that it is formed like an arrow head. If an electrical potential difference lower than the common electrode 63 is impressed to the orientation control auxiliary electrode 1 at this time, as the arrow head illustrated, the electric field of the perpendicularly it faces to the orientation control auxiliary electrode 1 from the common electrode 63 will be formed. On the contrary, when impressing an electrical potential difference lower than the common electrode 63 to the pixel electrode 55, an electrical potential difference higher than the common electrode 63 is impressed to the orientation control auxiliary electrode 1. That is, with a pixel electrode, the reversed electrical potential difference is impressed to the orientation control auxiliary electrode 1 by making into a center the electrical potential difference impressed to a common electrode.

[0021] carry out for impressing which electrical potential difference -- strong vertical electric field arise to the field of the orientation control aperture 65 with the orientation control auxiliary electrode 1. Orientation of the liquid crystal which has a negative dielectric constant anisotropy is carried out to electric field in a perpendicular and the direction of inclination of field strength. Therefore, if vertical electric field arise directly under an orientation control aperture with the orientation control auxiliary electrode 1, as compared with the former which electric field did not produce, the direction of orientation of liquid crystal can be controlled more strongly here. If orientation control becomes strong, the time amount (response time) in which a liquid crystal molecule shifts to a drive condition from initial orientation will become short. Moreover, even if the liquid crystal for example, in the orientation control aperture 56 inclines in the false direction, since orientation control is strongly carried out by disturbance, the direction of orientation of the liquid crystal between pixels stops being able to influence easily in a pixel, and the display quality of liquid crystal of an orientation control aperture edge of LCD improves according to it.

[0022] Moreover, since an electrical potential difference is impressed to the orientation control auxiliary electrode 1 superimposed on the orientation control aperture as mentioned above, even if a glass substrate is charged, the charge by which induction was carried out does not accumulate there and it is hard to be influenced of electrification.

[0023] A top view for drawing 2 (a) to explain actuation of this operation gestalt and drawing 2 (b) are the top views on which only the orientation control auxiliary electrode was simplified and drawn. As for this operation gestalt, an electrical potential difference is impressed by the Rhine reversal method. Suppose that the high electrical potential difference Vhigh was impressed to pixel electrode 10aa to the common electrode 61 as shown in drawing 2 (a). Plus is displayed on the electrode to which Vhigh is impressed among drawing. Since it is the Rhine reversal, pixel electrode 10ab in the same line also serves as Vhigh. The low electrical potential difference Vlow is impressed to pixel electrode 10ba of the line which adjoins the line of pixel electrode 10aa, and 10bb to the common electrode 61. With the pixel electrode with which the orientation control auxiliary electrode 1 counters the orientation control auxiliary electrode 1, the reversed electrical potential difference is impressed, Vlow is impressed to pixel electrode 10aa and orientation control auxiliary-electrode 1a formed on 10ab, and Vhigh is impressed to orientation control auxiliary-electrode 1b formed on pixel electrode 10ba and 10bb.

[0024] When the data line impresses an electrical potential difference to each pixel electrode, in order to improve electrical-potential-difference responsibility, just before impressing the electrical potential difference of the data line, Vhigh or Vlow is impressed, and the data line reduces this electrical potential difference to the electrical potential difference according to the display screen, and let it be the applied voltage for every pixel. This is called precharge. In order to precharge, there is an electrode by which electrical-potential-difference impression was carried out by AC with the amplitude of Vhigh to Vlow, and this is called a precharge electrode. As shown in drawing 2 (b), the orientation control auxiliary electrode in every other line is connected mutually. That is, orientation control auxiliary-electrode of odd lines 1a and orientation control auxiliary-electrode of even lines 1b are connected mutually. And it is in contact with the 1st substrate at the screen edge which is not illustrated, and either orientation control auxiliary-electrode 1a or 1b is connected to the precharge electrode 20 formed on the 1st substrate through the switch 21.

[0025] Electrical-potential-difference impression of the orientation control auxiliary electrode 1 is carried out with the pixel electrode 55 of the line which adjoins the pixel electrode 55 with which the orientation control auxiliary electrode 1 counters. It explains concretely below. To the timing which impresses a forward (Vhigh) electrical potential difference to the pixel electrode of odd lines, i.e., the pixel electrode which counters orientation control auxiliary-electrode 1a, the precharge electrode 20 is impressed to forward (Vhigh), and is impressed to orientation control auxiliary-electrode of even lines 1b being connected to the precharge electrode 20 (Vhigh) at this time. Next, if it becomes the timing which impresses a negative (Vlow) electrical potential difference to the pixel electrode of even lines, i.e., the pixel electrode which counters orientation control auxiliary-electrode 1b, the precharge electrode 20 is also impressed to negative (Vlow), and a switch 21 will change so that orientation control auxiliary-electrode of odd lines 1a may be connected to the precharge electrode 20 at this time, and it will be impressed by negative (Vlow). Electrical-potential-difference impression is repeated like the following. Therefore, as for a pixel electrode and the orientation control auxiliary electrode which counters the pixel electrode, the electrical potential difference of reversed polarity is impressed for any line. If electrical-potential-difference impression is carried out by the Rhine reversal method, since the same electrical potential difference of Vhigh or Vlow is impressed every other line and the orientation control auxiliary electrode 1 in every other line is connected mutually, electrical-potential-difference impression can be performed easily. And by the Rhine reversal method, since the electrical potential difference is impressed, whenever it carries out electrical-potential-difference impression with the pixel electrode of an adjoining line, with the pixel electrode, the reversed electrical potential difference will be impressed to the orientation control auxiliary electrode corresponding to each pixel electrode.

[0026] Although the electrical potential difference reversed with the pixel electrode using the precharge electrode 20 as it is the Rhine reversal method as mentioned above can be impressed to an orientation control auxiliary electrode, the same electrical potential difference as the pixel electrode of each line same, of course for example, as 1 vertical-synchronization period instead of this limitation can be impressed, and it can carry out almost similarly in the field reversal method which impresses the reversed electrical potential difference at the next vertical-synchronization period with this.

[0027] In addition, although it is not necessary to prepare specially connection section 1a of the orientation control auxiliary electrode 1 if the corner of the orientation control auxiliary electrode 1 is connected and formed as shown in drawing 3 (a), the direction in which connection section 1a was prepared can reduce the electric resistance of the orientation control auxiliary electrode 1. Of course, since the gate line 51 and TFT53 crowd and it is formed between pixels although electric resistance can be reduced further if it forms in the both sides of a pixel as shown in drawing 3 (b), it is hard to secure a tooth space. Moreover, since this part serves as a protection-from-light field and a numerical aperture is reduced when the orientation control auxiliary electrode 1 is formed with a metal, the smaller one of the field of the orientation control auxiliary electrode 1 is desirable.

[0028] Moreover, that what is necessary is just to insulate with the common electrode 63, although the orientation control auxiliary electrode 1 was formed between the 2nd substrate 60 and a color filter 61, as long as it is LCD which may form an insulator layer 62 more thickly and does not have a color filter 61, in short, a special insulator layer may be prepared instead of a color filter 61. However, if a special insulator layer is prepared, the transmitted light will decline within an insulator layer and the part permeability will fall. Since a color filter 61 is generally an insulator layer, if the orientation control auxiliary electrode 1 and the common electrode 63 are insulated with a color filter 61, permeability will not fall.

[0029] The top view in which drawing 4 (a) shows the 2nd operation gestalt, and (b) are the sectional view. The configuration of orientation control aperture 65' is a straight line-like, and the difference with the 1st operation gestalt of this operation gestalt is the point that double with it and the configuration of the orientation control auxiliary electrode 2 is changed. The orientation control auxiliary electrode 2 is superimposed and formed in orientation control aperture 65', and is connected with the line writing direction by connection section 2a. About the other configuration, since it is the same as that of the 1st operation gestalt, explanation is omitted.

[0030] The configuration of the orientation control aperture 65 can consider various things besides these [1st] and the 2nd operation gestalt, and is various with it. [of the configuration of an orientation control auxiliary electrode] The place considered as the point of this invention is the point that an orientation control aperture is overlapped on the field by which opening is carried out, and the orientation control auxiliary electrode is formed. This will become clearer also from the following operation gestalt.

[0031] The top view in which drawing 5 (a) shows the 3rd operation gestalt, and drawing 5 (b) are the

sectional view. The difference with the 1st operation gestalt of this operation gestalt is a point which the orientation control auxiliary electrode 3 consists of transparent electrodes, such as ITO, covers the pixel electrode of a line writing direction, and is formed all over the. Since the orientation control auxiliary electrode 3 is transparent, even if it forms in the whole surface in this way, it does not serve as hindrance of a screen display. Moreover, since the orientation control auxiliary electrode 3 of a line writing direction connects and is formed, as illustrated, it is the stripe-like orientation control auxiliary electrode 3 for every line of a pixel. Since the area of the orientation control auxiliary electrode 3 and the common electrode 64 which counters is large, the parasitic capacitance produced among these becomes large, and stops however, answering electrical-potential-difference impression quickly with this operation gestalt especially. Therefore, as for the orientation control auxiliary electrode 3 and the common electrode 64, it is desirable to take distance as much as possible. Although what is necessary is just to form the thickness of an insulator layer 62 thickly in order to take this distance, there is a possibility that permeability may fall. In this operation gestalt, the orientation control auxiliary electrode 3 was formed between the 2nd substrate 60 and a color filter 61, and the part of the thickness of a color filter and this distance are secured.

[0032]

[Effect of the Invention] Since the orientation control auxiliary electrode was prepared in the field corresponding to the pixel electrode of a common electrode between a common electrode and the 2nd substrate in the perpendicular orientation mold LCD which has the orientation control aperture which comes to carry out opening of the common electrode according to this invention as explained above Since the direction of orientation of liquid crystal can be controlled more strongly, the direction of orientation of liquid crystal is stabilized, it is hard coming to win popularity effect to disturbance, such as external electric field, and display quality improves.

[0033] Moreover, especially according to invention according to claim 5, a drive method is the Rhine reversal method, and since electrical-potential-difference impression is carried out with the pixel electrode of the line which adjoins the line of the pixel electrode with which the orientation control auxiliary electrode counters, an orientation control auxiliary electrode can impress a pixel electrode and the reversed electrical potential difference to an orientation control auxiliary electrode, without needing a special control circuit etc.

[Translation done.]

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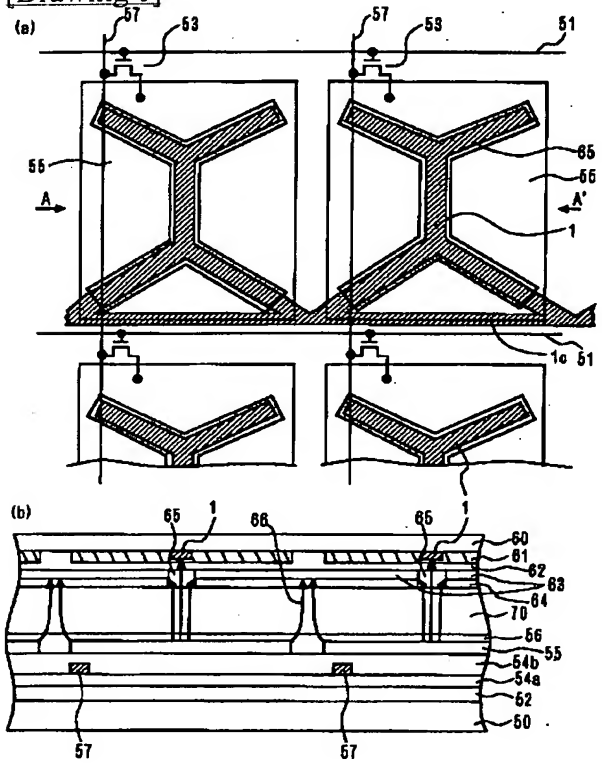
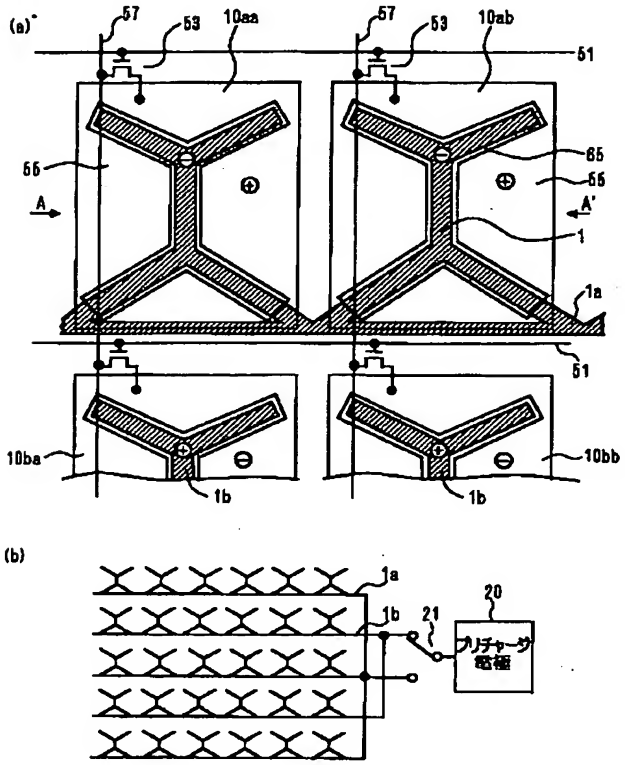
DRAWINGS

[Drawing 1]



[Drawing 2]



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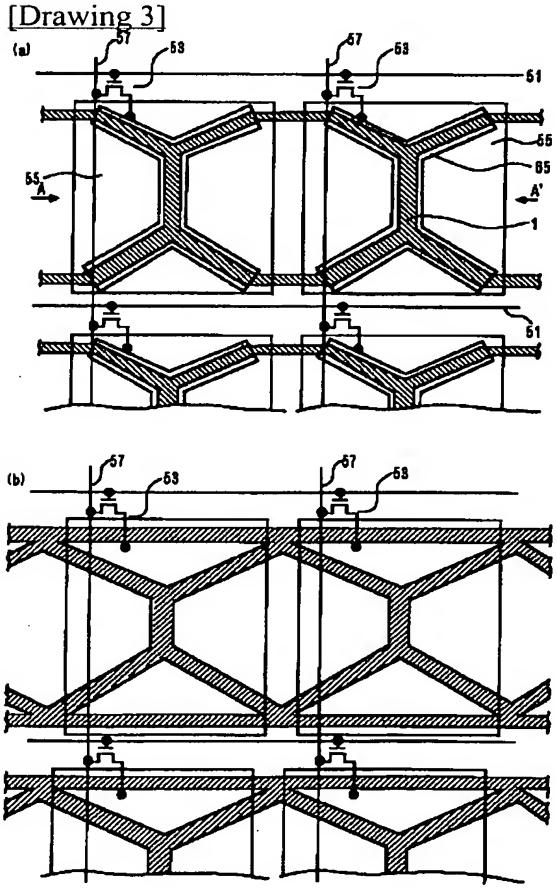

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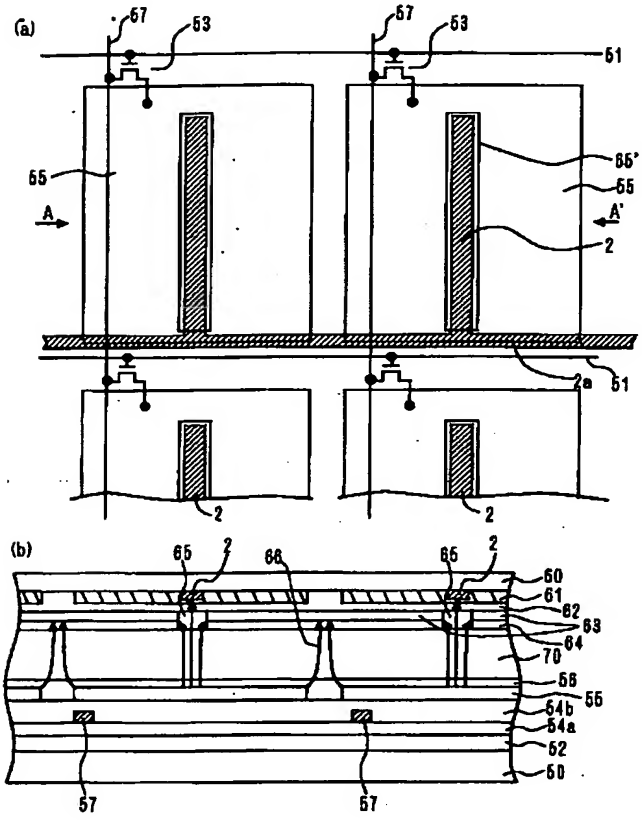

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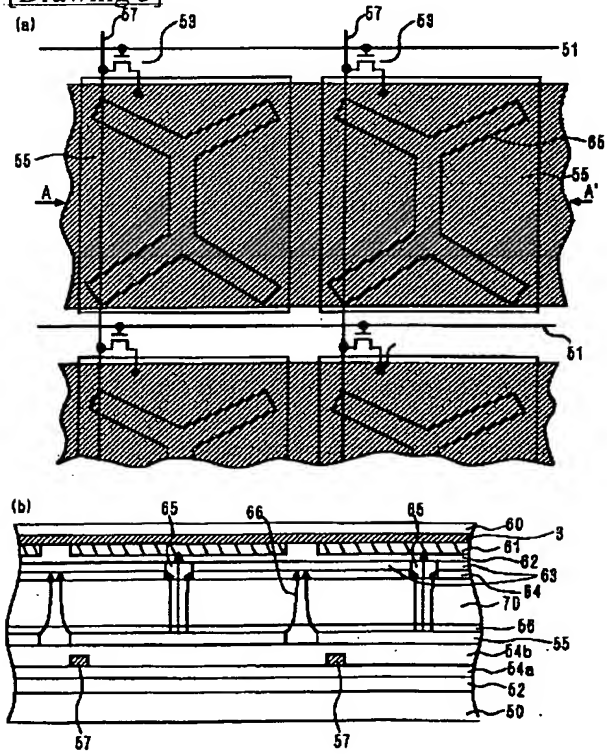
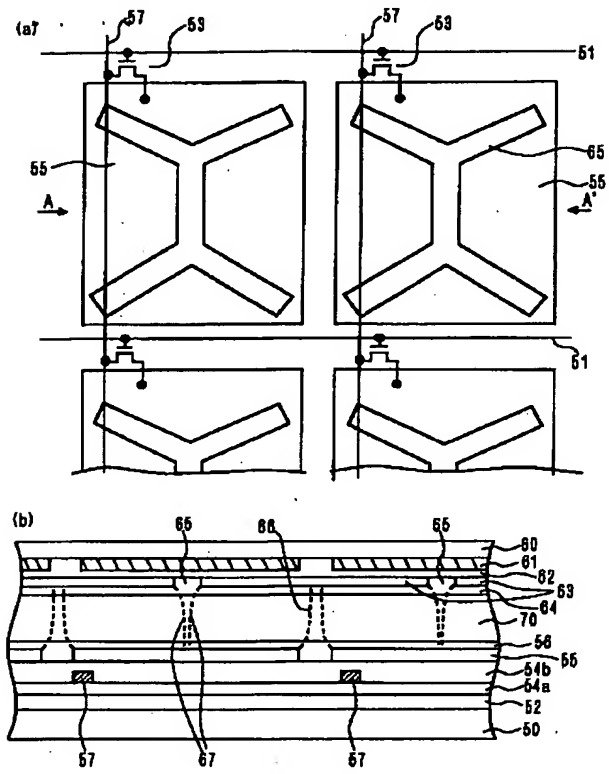
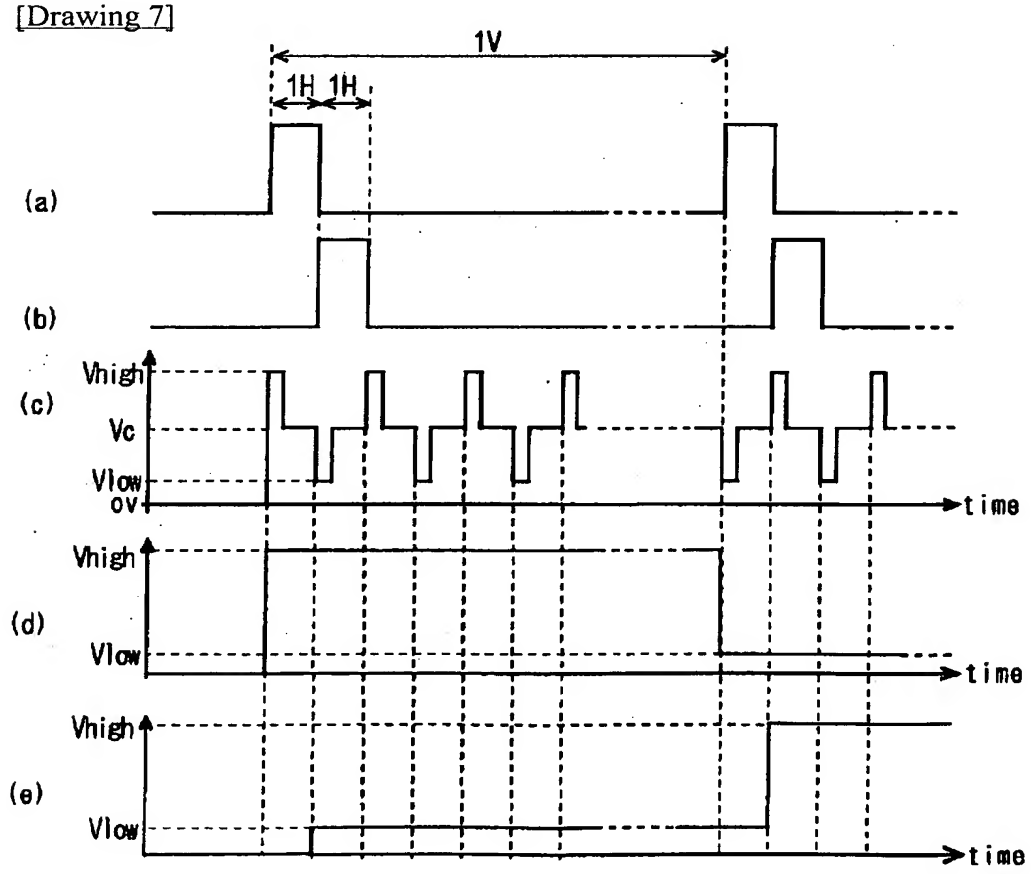


[Drawing 6]



[Drawing 7]



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(19)日本国特許庁（ＪＰ）　(12) **公開特許公報（Ａ）**　(11)特許出願公開番号
特開2000－267122
（P2000－267122A）
(43)公開日　平成12年９月29日(2000.9.29)

(51)Int.Cl.'		識別記号	FI			テーマコード'(参考)
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	1/1365		Ｇ０９Ｆ	9/30	３４９Ａ	５Ｃ０５８
Ｇ０９Ｆ	9/30	３４９		9/35	３０８	５Ｃ０６０
	9/35	３０８	Ｈ０４Ｎ	5/66	１０２Ａ	５Ｃ０９４
Ｈ０４Ｎ	5/66	１０２		9/30		

審査請求　未請求　請求項の数７　ＯＬ　（全　９　頁）　最終頁に続く

(21)出願番号　特願平11－68711

(22)出願日　平成11年３月15日(1999.3.15)

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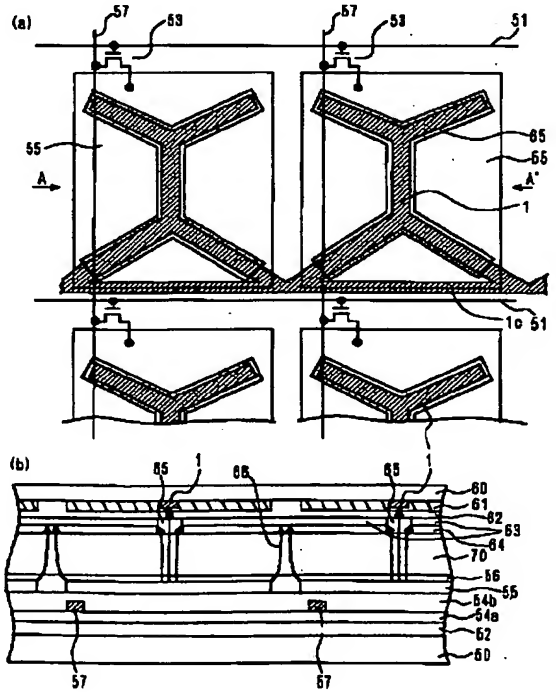
(54)【発明の名称】　垂直配向型液晶表示装置

(57)【要約】
【課題】　共通電極に配向制御窓を形成して配向方向を制御する垂直配向型液晶表示装置において、外乱による配向方向の乱れを防止し、表示品質の高い液晶表示装置を提供することを目的とする。
【解決手段】　対向する基板５０，６０上に画素電極５５や、配向制御窓６５が開口された共通電極６３が形成されている。配向制御窓６５に重畳する領域で、基板６０とカラーフィルタ６１との間に配向制御補助電極１が形成され、画素電極と極性の異なる電圧が印加されている。これによって、配向制御窓の領域に電界を形成し、液晶分子の配向方向をより強く制御する。



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【特許請求の範囲】

【請求項１】　互いに離間された画素電極が複数行形成された第１の基板と、前記第１の基板に対向し、前記画素電極に対向する共通電極が形成された第２の基板と、前記第１及び第２の基板間に封入された負の誘電率異方性を有する液晶とを備えた液晶表示装置において、前記共通電極の前記画素電極に対応する領域に、前記共通電極を開口してなる配向制御窓を有し、前記共通電極と前記第２の基板との間に配向制御補助電極を設けたことを特徴とする垂直配向型液晶表示装置。

【請求項２】　前記配向制御補助電極は、絶縁膜を介して前記配向制御窓に重畳して形成されていることを特徴とする請求項１に記載の垂直配向型液晶表示装置。

【請求項３】　前記配向制御補助電極と共通電極の間にある絶縁膜の少なくとも一部分は、透過する光を所定の色とするカラーフィルタであることを特徴とする請求項２に記載の垂直配向型液晶表示装置。

【請求項４】　前記配向制御補助電極は透明電極であり、該配向制御補助電極は前記画素電極に対向する領域全面に形成されていることを特徴とする請求項１に記載の垂直配向型液晶表示装置。

【請求項５】　前記配向制御補助電極は、行方向に連結されており、該配向制御補助電極には、該配向制御補助電極が対向する画素電極に印加される電圧とは前記共通電極に印加される電圧を中央として逆極性の電圧が印加されることを特徴とする請求項１乃至請求項３に記載の垂直配向型液晶表示装置。

【請求項６】　前記液晶表示装置の電圧印加方式は、行毎に印加電圧を反転させるライン反転方式で印加され、前記配向制御補助電極は、該配向制御補助電極が対向する前記画素電極に隣接する行の前記画素電極と共に、電圧印加されることを特徴とする請求項５に記載の垂直配向型液晶表示装置。

【請求項７】　前記データ線に接続され、前記画素電極にプリチャージするプリチャージ電極を更に有し、前記配向制御補助電極は、前記プリチャージ電極によって電圧を供給されることを特徴とする請求項６に記載の垂直配向型液晶表示装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、液晶表示装置（Liquid Crystal Display；ＬＣＤ）に関し、さらに詳しくは、配向制御窓を有する垂直配向型ＬＣＤの表示品質の改善に関する。

【０００２】

【従来の技術】負の誘電率異方性を有した液晶と、垂直配向膜とを用いた垂直配向型のＬＣＤにおいて、例えば特開平６－３０１０３６号などに、液晶の配向方向を制御する配向制御窓を有する垂直配向型ＬＣＤが提案されている。以下にこのタイプのＬＣＤについて説明する。

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【０００３】図６（ａ）は配向制御窓を有するＬＣＤの平面図、図６（ｂ）はそのＡ－Ａ’断面図である。第１の基板５０上に、ゲート線５１が形成され、これを覆ってゲート絶縁膜５２が形成されている。この上には、ポリシリコン膜よりなる薄膜トランジスタ（Thin Film Transistor；ＴＦＴ）５３が形成されている。ゲート線５１の一部は、ＴＦＴ５３のゲート電極となっている。これらを覆って層間絶縁膜５４が形成され、層間絶縁膜５４上には、ＩＴＯ（indium tin oxide）よりなる画素電極５５が形成され、層間絶縁膜５４に開口されたコンタクトホールを介してＴＦＴ５３に接続されている。画素電極５５の上には、ポリイミドのような有機系材料もしくは、シラン系材料のような無機系材料よりなる垂直配向膜５６が形成されている。層間絶縁膜５４は、２層になっており、層間絶縁膜５４ａ上には、データ線５７が形成されている。データ線５７はＴＦＴ５３のソース領域に接続され、ゲート線５１がオンしたときに画素電極５５に電荷を供給する。データ線５７に印加される電圧によって、液晶が直接傾斜される事を防止するため、データ線５７は、画素電極５５の下に重畳して形成されている。

【０００４】第１の基板５０に対向して配置された第２の基板６０には、画素電極５５に対向する位置にカラーフィルター６１が設けられ、さらに絶縁膜６２を介してＩＴＯ等よりなる共通電極６３が複数の画素電極５５を覆って形成されている。共通電極６３上には、第１の基板５０側と同じ垂直配向膜６４が設けられている。共通電極６３には、画素電極５５に対応する位置に配向制御窓６５が設けられている。配向制御窓６５は、共通電極が開口された電極不在の領域であり、例えば図示したように「Ｙ」の文字を上下逆に連結した形状を有する。

【０００５】これら第１の基板５０および第２の基板６０の間には、液晶７０が封入され、画素電極５５と共通電極６３の間に印加された電圧によって形成された電界強度に応じて、液晶分子の向き即ち配向が制御される。第１の基板５０および第２の基板６０の外側には、図示しない偏光板が、偏光軸を直交させて配置されている。これら偏光板間を通過する直線偏光は、各表示画素毎に異なる配向に制御された液晶７０を通過する際に変調され、所望の透過率に制御される。

【０００６】液晶７０は負の誘電率異方性を有しており、即ち、電界方向に対して倒れるように配向する性質を有している。垂直配向膜５６，６４は、液晶７０の初期配向を垂直方向に制御する。この場合、電圧無印加時には、液晶分子は垂直配向膜５６，６４に垂直になっており、一方の偏光板を抜けた直線偏光は、液晶層７０を通過して他方の偏光板により遮断されて表示は黒として認識される。この構成で、画素電極５５と共通電極６３間に電圧を印加すると、電界６６，６７が形成され、液晶分子は傾斜する。画素電極５５の端部では、電界６６

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は、画素電極５５から共通電極６３側へ向かって斜めに傾いた形状になる。同様に、配向制御窓６５の端部も電極が不在であるため、電界６７は画素電極５５に向かって傾いた形状になる。この傾いた電界に垂直になるように液晶の配向方向が制御されるため、液晶分子は画素電極５５の内側方向、配向制御窓６５に向かって傾斜する。この結果、一方の偏光板を抜けた直線偏光は、液晶層７０にて複屈折を受け、楕円偏光に変化して他方の偏光板を通過し、表示は白に近づいていく。

【０００７】画素電極５５は、ゲート線５１とデータ線５７が両方オンするとＴＦＴを介して電圧が印加され、その直上の液晶を駆動する。それぞれの画素電極５５に、それぞれの電圧を印加することによってＬＣＤの表示を行う。つまり、画素電極５５が形成されている領域が画素となる。

【０００８】また、配向制御窓６５直下では、共通電極６３が不在であるので電圧印加によっても電界が形成されず、液晶分子は初期配向状態、即ち垂直方向に固定される。これによって、液晶の連続体性によって配向制御窓６５を挟んで液晶の配向方向が対向し、広い視野角が得られる。

【０００９】次にＬＣＤの電圧印加方式について述べる。図７は、ゲート線５１及びデータ線５７に印加する電圧と、それによって駆動される画素電極の電圧を示すタイミングチャートである。図７（ａ）は第１のゲート線５１に、（ｂ）は第１のゲート線に隣接する第２のゲート線５１に、（ｃ）はデータ線５７に、それぞれ印加する電圧を示し、（ｄ）は第１のゲート線とデータ線によって制御される画素電極５５、（ｅ）は第２のゲート線とデータ線によって制御される画素電極５５の電圧を示している。１水平同期期間（以降１Ｈと表記する）第１のゲート線５１に電圧を印加し、これをオンする。第１のゲート線５１がオンすることで、これに対応した列の画素電極５５のＴＦＴ５３がオンする。１Ｈの間それぞれのデータ線５７には、表示する画像に応じた電圧が印加され、この列の画素電極５５はその電圧を保持する。次の１Ｈで、第１のゲート電極５１はオフし、第２のゲート電極５１がオンする。これによって、第２のゲート線に対応した画素電極５５のＴＦＴがオンし、同様にデータ線５７の電圧を、この列の画素電極５５が保持する。以下同様に、１Ｈ毎に各行の画素電極５５に電圧を与え、これに対応する液晶を駆動し、画像を表示する。ここで、液晶の劣化を防止するため、隣接する行毎に電界の方向を反転させる。即ち、第１のゲート線が制御する行の画素電極５５は、共通電極６３の電位Ｖｃ（例えば６Ｖ）よりも所定電位（例えば４Ｖ）高い電圧V_{high}（１０Ｖ）を印加し、隣接する行の画素電極５５には、反転した電圧、即ち共通電極６３の電位Ｖｃよりも所定電位低い電圧V_{low}（２Ｖ）を印加する。再び第１のゲート線の行の画素電極５５に電圧を印加する際

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は、先ほどとは反転したV_{low}を印加する。このような電圧の印加方式をライン反転方式と呼ぶ。ライン反転によると、共通電極６３の電位Ｖｃを中心に画素電極の印加電圧が反転しているので、電界は形状が同様で、方向が行毎に逆となる。

【００１０】

【発明が解決しようとする課題】上述の配向制御窓を有するタイプの垂直配向型ＬＣＤは、一般的に、ラビングを施して液晶の配向方向を制御するタイプのＬＣＤに比較して、配向方向を制御する力が弱く、例えば液晶層７０の厚さを規定しているスペーサの分布の偏りによって液晶層７０の厚さが変化したり、外界から電界がかかったりするなど、配向方向を乱す要因（以下では外乱と呼ぶ）があると、液晶の配向方向が乱れ、画素の視角特性が変化する。液晶は連続体性を有し、一部の配向方向の乱れは、画素内の液晶の配向方向にも影響を与える。配向方向の乱れた液晶は、どこかで（時により不定である）正しい配向方向の液晶との境界が生じ、ここは配向方向の不連続面、いわゆるディスクリネーションとなる。ディスクリネーションが発生した領域は光が透過しないので、開口率が低下する。また、外乱による配向方向の乱れは、画素毎に異なって生じるため、画面がざらついて見え、ＬＣＤの表示品質が低下する。

【００１１】また、ガラス基板が外的要因によって例えばプラスに帯電すると、対向する領域は逆電荷、即ちマイナスに帯電する。共通電極には電圧が印加されるので、帯電の影響は少ないが、配向制御窓には電極が形成されておらず、電圧印加されないので、帯電したままとなる。配向制御窓内が帯電すると、これによって予定していない電界が発生し、画素内の液晶分子の配向方向に影響を及ぼす。巨視的には帯電の影響は部分的にシミのように色が変わってみえる。また、帯電も上記外乱となりうる。

【００１２】本発明は、配向制御窓を有するタイプの垂直配向型ＬＣＤにおいて、より表示品質の高いＬＣＤを提供することを目的とする。

【００１３】

【課題を解決するための手段】本発明は、上記目的を達成するためになされ、互いに離間された画素電極が複数行形成された第１の基板と、第１の基板に対向し、画素電極に対向する共通電極が形成された第２の基板と、第１及び第２の基板間に封入された負の誘電率異方性を有する液晶とを備えた液晶表示装置において、共通電極の画素電極に対応する領域に、共通電極を開口してなる配向制御窓を有し、共通電極と第２の基板との間に配向制御補助電極を設けた垂直配向型液晶表示装置である。

【００１４】また、配向制御補助電極は、配向制御窓に重畳して形成されている。

【００１５】また、配向制御補助電極は透明電極であり、画素電極に対向する領域全面に形成されている。

【００１６】また、液晶表示装置は、画素電極に電圧を印加して液晶を駆動し、配向制御補助電極は、行方向に連結されており、該配向制御補助電極には、該配向制御補助電極が対向する画素電極とは反転した電圧が印加される。

【００１７】また、液晶表示装置の電圧印加方式は、行毎に印加電圧を反転させるライン反転方式で印加され、配向制御補助電極は、該配向制御補助電極が対向する画素電極の行に隣接する行の画素電極と共に、電圧印加される。

【００１８】

【発明の実施の形態】図１（ａ）は本発明の第１の実施形態の平面図、（ｂ）はその断面図である。従来のＬＣＤと同様の構成については同じ番号を付し、説明を省略する。第１の基板５０上に、行方向に延在するゲート線５１が形成され、その一部をゲート電極としたＴＦＴ５３が形成されている。列方向に延在するデータ線５７はＴＦＴ５３を介して画素電極５５に接続されており、画素電極５５の上には、ラビング処理が施されていない垂直配向膜５６が形成されている。データ線５７は層間絶縁膜５４ａ上に形成されている。第１の基板５０に対向して配置された第２の基板６０上には、カラーフィルタ６１が形成され、この上に絶縁膜６２を介して共通電極６３と、ラビング処理が施されていない垂直配向膜６４が設けらている。共通電極６３には、液晶の配向方向を制御する配向制御窓６５が形成されている。これら第１の基板５０および第２の基板６０の間には、負の誘電率異方性を有する液晶７０が装填され、画素電極５５と共通電極６３間に印加された電圧によって形成された電界強度に応じて配向が制御される。

【００１９】従来との大きな違いは、第２の基板６０とカラーフィルタ６１との間に配向制御補助電極１が形成されている点である。配向制御補助電極１は、配向制御窓６５が形成された領域に重畳するように、「Ｙ」文字を上下逆に連結した形状に、行方向に連結する連結部１ｃを接続した形状を有し、例えばクロムなどの金属や、ＩＴＯなどの透明電極からなる。ただし、透明電極は一般的に金属に比較して抵抗が高いので、金属である方が望ましい。

【００２０】今、画素電極５５に共通電極６３よりも高い電圧が印加され、画素電極５５から共通電極６３に向かう電気力線が矢印のように形成されているとする。このとき、配向制御補助電極１に共通電極６３よりも低い電圧を印加すると、矢印で図示したように、共通電極６３から配向制御補助電極１に向かう垂直方向の電界が形成される。逆に、画素電極５５に共通電極６３よりも低い電圧を印加するときは、配向制御補助電極１には、共通電極６３よりも高い電圧を印加する。つまり、配向制御補助電極１には、共通電極に印加する電圧を中央として、画素電極とは反転した電圧を印加する。

【００２１】いずれの電圧を印加するにせよ、配向制御補助電極１によって配向制御窓６５の領域に、垂直方向の強い電界が生じる。負の誘電率異方性を有する液晶は、電界に垂直、電界強度の勾配方向に配向される。従って、配向制御補助電極１によって配向制御窓直下に垂直方向の電界が生じると、ここに電界が生じなかった従来に比較して、より強く液晶の配向方向を制御することができる。配向制御が強くなると、液晶分子が初期配向から駆動状態へ移行する時間（応答時間）が短くなる。また、もし外乱によって、例えば配向制御窓５６内の液晶があらぬ方向に傾斜したとしても、配向制御窓端部の液晶は強く配向制御されているので、画素間の液晶の配向方向が画素内に影響しにくくなり、ＬＣＤの表示品質が向上する。

【００２２】また、上述のように配向制御窓に重畳した配向制御補助電極１に電圧が印加されるので、ガラス基板が帯電しても、誘起された電荷がそこにたまることがなく、帯電の影響は受けにくい。

【００２３】図２（ａ）は本実施形態の動作を説明するための平面図、図２（ｂ）は配向制御補助電極のみを簡略化して描いた平面図である。本実施形態はライン反転方式によって電圧が印加される。図２（ａ）に示すように画素電極１０ａａに、共通電極６１に対して高い電圧V_{high}が印加されていたとする。図中、V_{high}が印加されている電極にはプラスを表示している。ライン反転であるので、同じ行にある画素電極１０ａｂもV_{high}となる。画素電極１０ａａの行に隣接する行の画素電極１０ｂａ、１０ｂｂには、共通電極６１に対して低い電圧Ｖlowが印加される。配向制御補助電極１には、その配向制御補助電極１が対向する画素電極とは反転した電圧が印加され、画素電極１０ａａ、１０ａｂ上に形成された配向制御補助電極１ａには、V_{low}が印加され、画素電極１０ｂａ、１０ｂｂ上に形成された配向制御補助電極１ｂにはV_{high}が印加される。

【００２４】データ線が各画素電極に電圧を印加するときに電圧応答性をよくするために、データ線の電圧を印加する直前にV_{high}もしくはV_{low}を印加し、データ線はこの電圧を、表示画面に応じた電圧まで低下させて各画素毎の印加電圧とする。これをプリチャージと呼ぶ。プリチャージを行うためにV_{high}からV_{low}の振幅でＡＣで電圧印加された電極があり、これをプリチャージ電極と呼ぶ。図２（ｂ）に示すように、１行おきの配向制御補助電極は互いに接続されている。即ち、奇数行の配向制御補助電極１ａと、偶数行の配向制御補助電極１ｂが互いに接続されている。そして、図示しない画面端部で第１の基板にコンタクトしており、第１の基板上に形成されたプリチャージ電極２０にスイッチ２１を介して配向制御補助電極１ａもしくは１ｂのいずれかが接続されている。

【００２５】配向制御補助電極１は、その配向制御補助

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電極１が対向する画素電極５５に隣接する行の画素電極５５と共に、電圧印加される。以下に具体的に説明する。奇数行の画素電極、即ち配向制御補助電極１ａに対向する画素電極に正（V_{high}）の電圧を印加するタイミングでは、プリチャージ電極２０は正（V_{high}）に印加されており、この時偶数行の配向制御補助電極１ｂがプリチャージ電極２０に接続されて（V_{high}）に印加される。次に偶数行の画素電極、即ち配向制御補助電極１ｂに対向する画素電極に負（V_{low}）の電圧を印加するタイミングになると、プリチャージ電極２０も負（V_{low}）に印加され、この時は奇数行の配向制御補助電極１ａがプリチャージ電極２０に接続されるようスイッチ２１が切り替わり、負（V_{low}）に印加される。以下同様に電圧印加を繰り返す。従って、いずれの行も画素電極とその画素電極に対向する配向制御補助電極とは逆極性の電圧が印加される。ライン反転方式で電圧印加すると、１行おきにV_{high}もしくはV_{low}の同じ電圧が印加され、１行おきの配向制御補助電極１が互いに接続されているので、容易に電圧印加ができる。そして、ライン反転方式によって、電圧が印加されているので、隣接する行の画素電極と共に電圧印加すれば、各画素電極に対応する配向制御補助電極には常にその画素電極とは反転した電圧が印加される。

【００２６】上述のようにライン反転方式であると、プリチャージ電極２０を用いて画素電極と反転した電圧を配向制御補助電極に印加できるが、もちろんこの限りではなく、例えば１垂直同期期間に同じ各行の画素電極に同じ電圧を印加し、次の垂直同期期間にこれと反転した電圧を印加するフィールド反転方式においてもほぼ同様に実施することができる。

【００２７】尚、配向制御補助電極１の連結部１ａは、図３（ａ）に示すように、配向制御補助電極１の隅を連結して形成すれば別段設ける必要はないが、連結部１ａを設けた方が配向制御補助電極１の電気抵抗を低減することができる。もちろん、図３（ｂ）に示すように、画素の両側に形成すると、さらに電気抵抗を低減できるが、画素間はゲート線５１やＴＦＴ５３が密集して形成されているので、スペースが確保しにくい。また、配向制御補助電極１を金属で形成した場合はこの部分は遮光領域となり、開口率を低下させるので、配向制御補助電極１の領域は小さい方が望ましい。

【００２８】また、配向制御補助電極１は第２の基板６０とカラーフィルタ６１との間に設けたが、要は、共通電極６３と絶縁されていれば良く、例えば絶縁膜６２をより厚く形成しても良く、またカラーフィルタ６１を有さないＬＣＤであれば、カラーフィルタ６１の替わりに別途絶縁膜を設けても良い。しかし、別途絶縁膜を設けると、絶縁膜内で透過光が減衰し、その分透過率が低下する。カラーフィルタ６１は一般的に絶縁膜であるので、カラーフィルタ６１によって配向制御補助電極１と

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共通電極６３とを絶縁すれば、透過率が低下することはない。

【００２９】図４（ａ）は第２の実施形態を示す平面図、（ｂ）はその断面図である。本実施形態の第１の実施形態との差違は配向制御窓６５’の形状が直線状であり、それに合わせ、配向制御補助電極２の形状が変更されている点である。配向制御補助電極２は、配向制御窓６５’に重畳して形成され、連結部２ａによって行方向に連結されている。それ以外の構成に関しては、第１の実施形態と同様であるので、説明を省略する。

【００３０】配向制御窓６５の形状は、これら第１，第２の実施形態以外にも様々なものが考えられ、それと共に配向制御補助電極の形状も様々である。本発明のポイントとするところは、配向制御窓が開口されている領域に重畳して配向制御補助電極が形成されている点である。このことは、下記の実施形態からもより明らかとなろう。

【００３１】図５（ａ）は第３の実施形態を示す平面図、図５（ｂ）はその断面図である。本実施形態の第１の実施形態との差違は配向制御補助電極３がＩＴＯなどの透明電極よりなり、行方向の画素電極を覆ってその全面に形成されている点である。配向制御補助電極３は透明であるので、このように全面に形成しても、画面表示の妨げとはならない。また、行方向の配向制御補助電極３が連結して形成されているので、図示したように、画素の各行毎にストライプ状の配向制御補助電極３となっている。ただし、特に本実施形態では、配向制御補助電極３と共通電極６４との対向する面積が大きいため、これらの間に生じる寄生容量が大きくなり、電圧印加に素早く応答しなくなる。従って、配向制御補助電極３と共通電極６４とは、できるだけ距離をとることが望ましい。この距離をとるためには絶縁膜６２の膜厚を厚く形成すればよいが、透過率が低下するおそれがある。本実施形態においては、配向制御補助電極３を第２の基板６０とカラーフィルター６１との間に形成し、カラーフィルタの厚みの分、この距離を確保している。

【００３２】

【発明の効果】以上に説明したように、本発明によれば、共通電極の画素電極に対応する領域に、共通電極を開口してなる配向制御窓を有する垂直配向型ＬＣＤにおいて、共通電極と第２の基板との間に配向制御補助電極を設けたので、液晶の配向方向をより強く制御することができるので、液晶の配向方向が安定し、外部電界などの外乱に対して影響を受けにくくなり、表示品質が向上する。

【００３３】また、特に請求項５に記載の発明によれば、駆動方式がライン反転方式であり、配向制御補助電極は、その配向制御補助電極が対向する画素電極の行に隣接する行の画素電極と共に電圧印加されるので、特別な制御回路などを必要とせずに配向制御補助電極に画素

電極と反転した電圧を印加することができる。

【図面の簡単な説明】

【図１】本発明の実施形態の平面図及び断面図である。

【図２】本発明の実施形態の平面図である。

【図３】本発明の別の実施形態の平面図である。

【図４】本発明の別の実施形態の平面図及び断面図である。

【図５】本発明の別の実施形態の平面図及び断面図である。

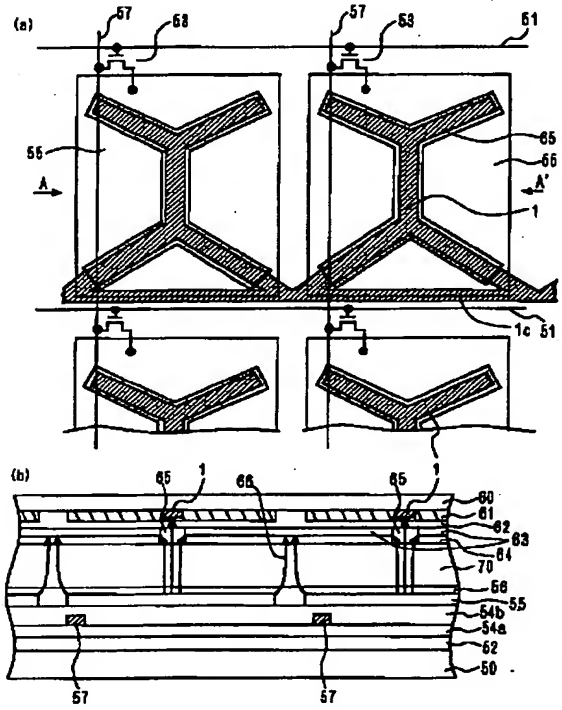
【図６】従来の液晶表示装置の平面図及び断面図である。

【図７】ライン反転による電圧印加を示すタイミングチャートである。

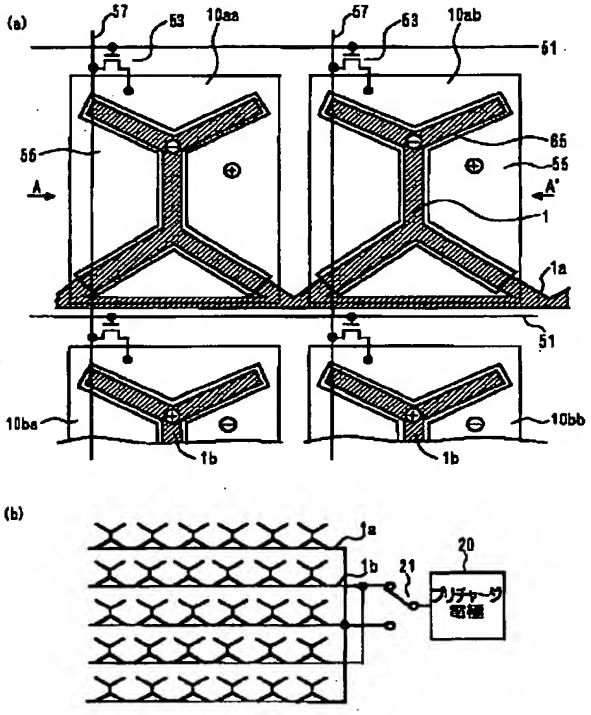
【符号の説明】

１，２，３：配向制御補助電極、５１：ゲート線、５３：ＴＦＴ、５５：画素電極、５７：データ線、６１：カラーフィルタ、６３：共通電極、６５：配向制御窓

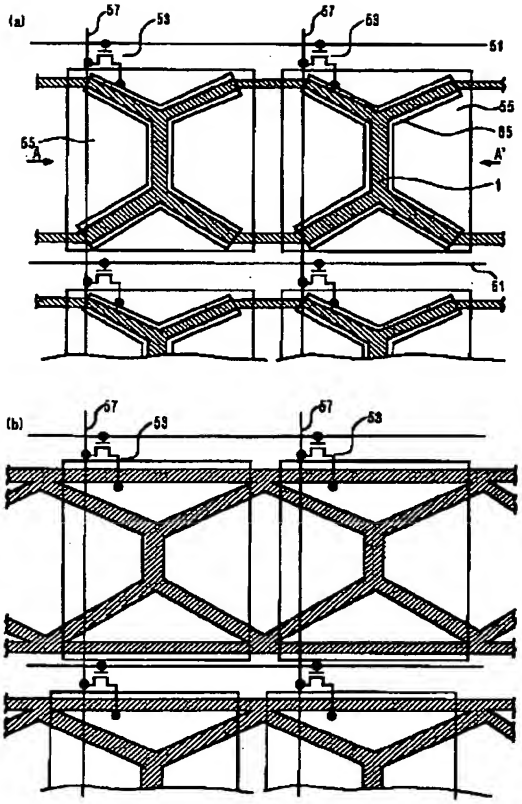
【図１】



【図２】



【図３】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51
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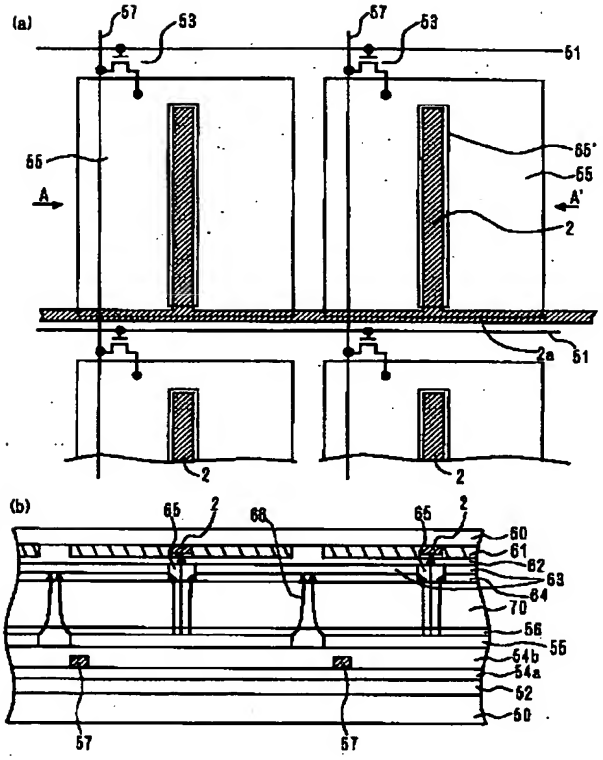
(b)

【図４】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70
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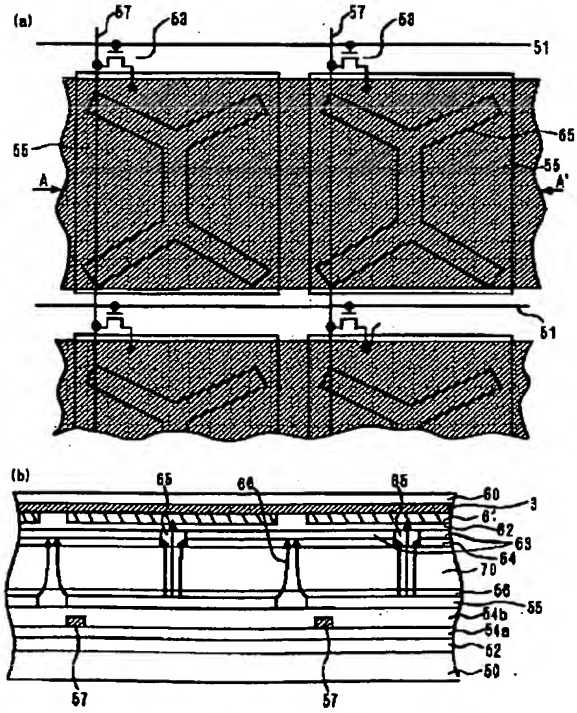
54b
54a
52
50
57

【図５】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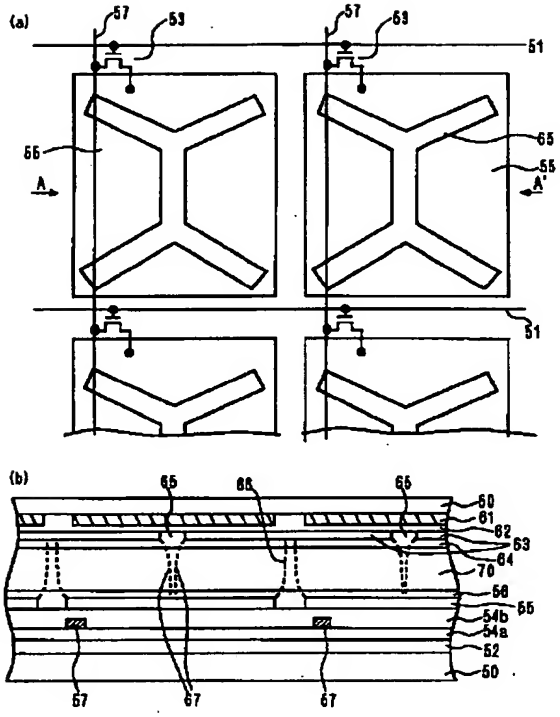
【図６】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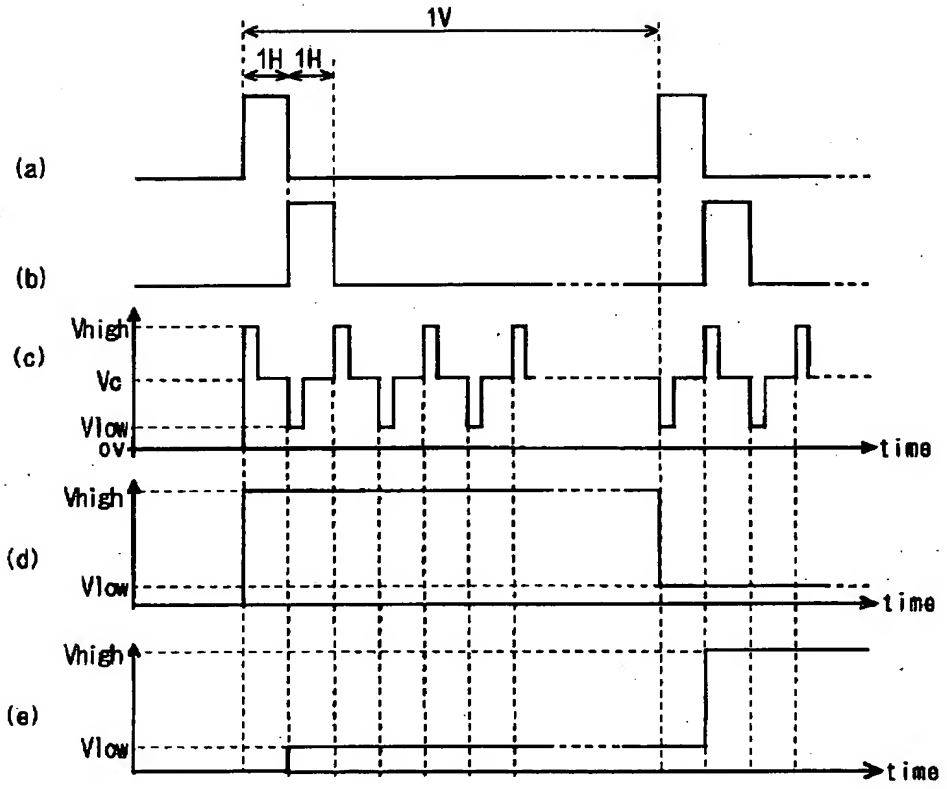
【図７】



フロントページの続き

(51)Int.Cl.[7]	識別記号	F I	テーマコード(参考)
H04N 9/30		G02F 1/136	500

Fターム(参考) 2H092 GA14 JA24 JB13 JB23 JB32
JB51 JB56 JB63 JB69 NA01
NA04 NA25 NA27 PA02 PA06
PA08 PA09 QA06 QA18
5C058 AA06 AB01 BA05 BA33 BA35
5C060 DA00 DA04 DA07 JA00 JA21
5C094 AA02 BA03 BA43 CA24 DA12
DA13 EA04 EA07 EA10 EB02
ED03